WHAT IS CLAIMED IS

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      1. An information recording/reproducing apparatus, comprising:

      a binary/multi-level data converting unit converting binary data into multi-level data;

10   a test data generating unit generating test data forming part of the multi-level data;

      a data recording unit recording the multi-level data including the test data to an information recording medium;

15   a signal reproducing unit outputting reproduction signals of the multi-level data including the test data from the information recording medium;

      a test data examining unit examining the reproduction signals of the multi-level data including

20   the test data to determine whether the test data is normal;

      a waveform equalization unit equalizing a waveform of the examined test data when the test data examining unit determines that the test data is normal;

25   and

a multi-level determining unit determining multi-level data by referring to a pattern table generated using the examined test data.

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2. The information recording/reproducing apparatus as claimed in claim 1, wherein the test data examining unit includes:

a data distinguishing unit categorizing an input data frame into a test frame including the test data and a data frame;

a distribution computing unit computing a frequency distribution of values for the reproduction signals of the test data;

a feature amount detection unit detecting a feature amount of the computed frequency distribution;

a comparing unit deciding whether the test data is normal by comparing the detected feature amount with a prescribed value; and

a memory unit storing the values of the reproduction signals of the test data.

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3.   The information recording/reproducing
apparatus as claimed in claim 2, wherein when the data
5   distinguishing unit determines that the input data frame
is the test frame, the waveform equalizing unit and the
multi-level determining unit stop operating, the
distribution computing unit starts computing the
frequency distribution of the values for the
10   reproduction signals of the test data, and the memory
unit stores the test data.

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4.   The information recording/reproducing
apparatus as claimed in claim 2, wherein when the
comparing unit decides that the test data is normal,
effective data in the memory unit is output to the
20   waveform equalization unit for determining a coefficient
of a filter of the waveform equalization unit according
to automatic equalization algorithm, and the effective
data is also output to the multi-level data determining
unit for generating the pattern table.

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5.   The information recording/reproducing
apparatus as claimed in claim 1, wherein the multi-level
data determining unit includes:

a pattern table generating unit generating the
pattern table; and

a multi-level data detecting unit detecting
the multi-level data by searching through the pattern
table for a pattern which is similar to effective data
in the memory unit.

6.   The information recording/reproducing
apparatus as claimed in claim 5, wherein when the test
data examining unit determines that the test data is
normal, the multi-level data detecting unit outputs the
effective data in the memory unit as multi-level data.

7. The information recording/reproducing apparatus as claimed in claim 2, wherein when the comparing unit decides that the test data is abnormal, the test data from the information recording medium is

5   examined again and input to the distribution computing unit.

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8. The information recording/reproducing apparatus as claimed in claim 7, wherein the test data is not used when the test data is again decided to be abnormal.

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9. The information recording/reproducing

20   apparatus as claimed in claim 2, wherein one or more test data from the information recording medium is examined, wherein when the feature amount of the test data surpasses a prescribed range, the value of the reproduction signals of the test data surpassing the

25   prescribed range is excluded, wherein an average of the

values of the reproduction signals of the test data except for the excluded test data is obtained for detecting the multi-level data.

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10. The information recording/reproducing apparatus as claimed in claim 9, wherein the test data is allocated before and after the multi-level data.

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11. The information recording/reproducing apparatus as claimed in claim 1, wherein the test data includes combinations of data comprising same numeric series.

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12. The information recording/reproducing apparatus as claimed in claim 1, wherein the test data includes combinations of data comprising different

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numeric series.

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13. An information recording/reproducing apparatus for reproducing multi-level data based on examined test data, wherein multi-level data is converted from binary data, test data is generated as part of multi-level data, and reproduction signals of the multi-level data including the test data are reproduced as reproduction signals including the test data, the information recording/reproducing apparatus comprising:

a test data examining unit examining the reproduction signals of the multi-level data including the test data to determine whether the test data is normal;

a waveform equalization unit equalizing a waveform of the examined test data when the test data examining unit determines that the test data is normal; and

a multi-level determining unit determining multi-level data by referring to a pattern table generated using the examined test data.

5   14.   An information recording medium comprising:

multi-level data converted from binary data; and

test data used in reproducing the multi-level
10   data,

wherein the test data includes combinations of data comprising same numeric series.

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15.   An information recording medium comprising:

multi-level data converted from binary data;
20   and

test data used in reproducing the multi-level data,

wherein the test data includes combinations of data comprising different numeric series.

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